Claims

For the convenience of the Examiner, a full listing of the pending claims is provided.

1. **(Previously Presented)** A system for carrying and moving an object in a plane, comprising:

an object carrier;

a first and a second linear actuator configured to support said object carrier and move said object carrier in a first direction, said first and second linear actuators extending in parallel along said first direction, said first and second linear actuators being electromagnetic linear actuators comprising:

a magnetic structure, and

a coil structure,

wherein the coil structure and the magnetic structure are positioned relative to each other and separated by an air bearing attached to the coil structure or the magnetic structure and configured to support said object carrier during motion at a first position along said first direction, the first position being on one end of whichever of the magnetic structure or coil structure is connected to the object carrier, and at a second position displaced from the first position along said first direction, the second position being on the opposite end of whichever of the magnetic structure or coil structure is connected to the object carrier, wherein the first and second positions and whichever of the magnetic structure or coil structure is connected to the object carrier are substantially in a same plane; and

a third and a fourth linear actuator configured to move said object carrier in a second direction, said third and fourth linear actuators extending in parallel along said second direction,

wherein both the coil structure and the magnetic structure of the first and second linear actuators are moveable with respect to each other or both a coil structure and a magnetic structure of the third and fourth linear actuators are moveable with respect to each other, the coil structure or the magnetic structure of the respective pair of coil structure and magnetic structure of the respective linear actuator configured as a balance mass to receive reaction forces arising from the movement of the other of the coil structure or the magnetic structure.

2. (**Original**) The system of Claim 1, wherein said third and fourth linear actuators are adapted to support said first and second linear actuators.

3. (**Cancelled**)

4. (**Original**) The system of Claim 2, wherein said third and fourth linear actuators each comprise an air bearing to support said first and second linear actuators.

5. (**Previously Presented**) The system of Claim 1, wherein said magnetic structure includes a row of alternating magnetic poles on an outer surface thereof, said row being orientated in said first direction; and

said coil structure includes an iron core with a number of teeth in a row orientated in said first direction and having a number of coils wound around a respective number of said teeth;

wherein the relative positioning of the coil structure and the magnetic structure is configured so that the row of magnetic poles is positioned opposing the row of teeth, around which coils are wound.

6. (**Cancelled**)

7. (**Original**) The system of Claim 2, wherein said third and fourth linear actuators are electromagnetic linear actuators, comprising:

a magnetic structure having a row of alternating magnetic poles on an outer surface thereof, said row being orientated in said first direction; and

a coil structure having an iron core with a number of teeth in a row orientated in said first direction and having a number of coils wound around a respective number of said teeth;

wherein the coil structure and the magnetic structure are positioned relative to each other such that the row of magnetic poles is positioned opposing the row of teeth around which coils are wound, the coil structure and the magnetic structure being separated by an air bearing.

8. (**Original**) The system of Claim 7, wherein said air bearing for separating the coil structure and the magnetic structure is adapted to support said first and second linear actuators.

9. (**Original**) The system of Claim 1, wherein said object carrier is positioned relative to said first and second linear actuators such that a vertical line through a center of gravity of said object carrier is located between said first and second linear actuators.

10. (**Original**) The system of Claim 2, wherein said first and second linear actuators are positioned relative to said third and fourth linear actuators such that a common center of gravity of said first and second linear actuators is positioned between said third and fourth linear actuators.

11. (**Original**) The system of Claim 1, wherein said first and second linear actuators are substantially symmetrically positioned with respect to the center of gravity of said object carrier.

12. (**Original**) The system of Claim 2, wherein said third and fourth linear actuators are substantially symmetrically positioned with respect to the common center of gravity of the first and second linear actuators.

13. (**Original**) The system of Claim 1, wherein said first and second linear actuators are positioned at opposite ends of the object carrier.

14. (**Original**) The system of Claim 2, wherein said third and fourth linear actuators are positioned at opposite ends of said first and second linear actuators.

15. (**Original**) The system of Claim 1, wherein said second direction is perpendicular to said first direction.

16. (**Original**) The system of Claim 1, further comprising a control system configured to control said first and second linear actuators.

17. (**Withdrawn - Previously Presented**) A lithographic apparatus, comprising:

an illumination system configured to provide a beam of radiation;

a carrier structure configured to carry a patterning device, the patterning device serving to impart the beam of radiation with a pattern in its cross-section;

a first and second linear actuator configured to support said carrier structure and move said carrier structure in a first direction, said first and second linear actuators extending in parallel along said first direction, said first and second linear actuators being electromagnetic linear actuators comprising:

a magnetic structure, and

a coil structure,

wherein the coil structure and the magnetic structure are positioned relative to each other and separated by an air bearing attached to the coil structure or the magnetic structure and configured to support said carrier structure during motion at a first position along said first direction, the first position being on one end of whichever of the magnetic structure or coil structure is connected to the carrier structure, and at a second position displaced from the first position along said first direction, the second position being on the opposite end of whichever of the magnetic structure or coil structure is connected to the carrier structure, wherein the first and second positions and whichever of the magnetic structure or coil structure is connected to the carrier structure are substantially in a same plane;

a third and a fourth linear actuator configured to move said carrier structure in a second direction, said third and fourth linear actuators extending in parallel along said second direction;

a substrate holder configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate,

wherein both the coil structure and the magnetic structure of the first and second linear actuators are moveable with respect to each other or both a coil structure and a magnetic structure of the third and fourth linear actuators are moveable with respect to each other, the coil structure or the

magnetic structure of the respective pair of coil structure and magnetic structure of the respective linear actuator configured as a balance mass to receive reaction forces arising from the movement of the other of the coil structure or the magnetic structure.

18. (**Withdrawn - Previously Presented**) A lithographic apparatus, comprising:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning device, the patterning device serving to impart the beam of radiation with a pattern in its cross-section;

a carrier structure configured to carry a substrate;

a first and second linear actuator configured to support said carrier structure and move said carrier structure in a first direction, said first and second linear actuators extending in parallel along said first direction, said first and second linear actuators being electromagnetic linear actuators comprising:

a magnetic structure, and

a coil structure,

wherein the coil structure and the magnetic structure are positioned relative to each other and separated by an air bearing attached to the coil structure or the magnetic structure and configured to support said carrier structure during motion at a first position along said first direction, the first position being on one end of whichever of the magnetic structure or coil structure is connected to the carrier structure, and at a second position displaced from the first position along said first direction, the second position being on the opposite end of whichever of the magnetic structure or coil structure is connected to the carrier structure, wherein the first and second

positions and whichever of the magnetic structure or coil structure is connected to the carrier structure are substantially in a same plane;

a third and a fourth linear actuator configured to move said carrier structure in a second direction, said third and fourth linear actuators extending in parallel along said second direction; and

a projection system configured to project the patterned beam onto a target portion of the substrate,

wherein both the coil structure and the magnetic structure of the first and second linear actuators are moveable with respect to each other or both a coil structure and a magnetic structure of the third and fourth linear actuators are moveable with respect to each other, the coil structure or the magnetic structure of the respective pair of coil structure and magnetic structure of the respective linear actuator configured as a balance mass to receive reaction forces arising from the movement of the other of the coil structure or the magnetic structure.

19. (**Previously Presented**) A method for carrying and moving an object in a plane, comprising:

positioning said object on an object carrier, said object carrier being moveable by a first and a second linear actuator in a first direction and by a third and a fourth linear actuator in a second direction, said first and second linear actuators being adapted to support said object carrier by having a coil structure and a magnetic structure that are separated by an air bearing attached to the coil structure or the magnetic structure and configured to support said object carrier during motion at a first position along said first direction, the first position being on one end of whichever of the magnetic structure or coil structure is connected to the object carrier, and at a second position displaced from the first position along said first direction, the second

position being on the opposite end of whichever of the magnetic structure or coil structure is connected to the object carrier, wherein the first and second positions and whichever of the magnetic structure or coil structure is connected to the object carrier are substantially in a same plane, and wherein both the coil structure and the magnetic structure of the first and second linear actuators are moveable with respect to each other or both a coil structure and a magnetic structure of the third and fourth linear actuators are moveable with respect to each other, the coil structure or the magnetic structure of the respective pair of coil structure and magnetic structure of the respective linear actuator configured as a balance mass to receive reaction forces arising from the movement of the other of the coil structure or the magnetic structure; and

controlling said first and second linear actuators to move said object carrier in said first direction.

20. (**Original**) The method of Claim 19, further comprising controlling said third and fourth linear actuators to move said object carrier in said second direction.

21–23. (**Cancelled**)

24. (**Withdrawn - Previously Presented**) A device manufacturing method, comprising:

providing a substrate;

providing a beam of radiation using an illumination system;

imparting the beam of radiation with a desired pattern in its cross-section based on a patterning device;

positioning said patterning device on an object carrier, said object carrier being moveable by a first and a second linear actuator in a first direction and by a third and a fourth linear actuator in a second direction, said first and second linear actuators being adapted to support said object carrier by having a coil structure and a magnetic structure that are separated by an air bearing attached to the coil structure or the magnetic structure and configured to support said object carrier during motion at a first position along said first direction, the first position being on one end of whichever of the magnetic structure or coil structure is connected to the object carrier, and at a second position displaced from the first position along said first direction, the second position being on the opposite end of whichever of the magnetic structure or coil structure is connected to the object carrier, wherein the first and second positions and whichever of the magnetic structure or coil structure is connected to the object carrier are substantially in a same plane, and wherein both the coil structure and the magnetic structure of the first and second linear actuators are moveable with respect to each other or both a coil structure and a magnetic structure of the third and fourth linear actuators are moveable with respect to each other, the coil structure or the magnetic structure of the respective pair of coil structure and magnetic structure of the respective linear actuator configured as a balance mass to receive reaction forces arising from the movement of the other of the coil structure or the magnetic structure;

controlling said first and second linear actuators to move said object carrier in said first direction; and

projecting the patterned beam of radiation onto a target portion of the substrate.

25. (**Withdrawn - Previously Presented**) A device manufacturing method, comprising:

providing a substrate;

providing a beam of radiation using an illumination system;

imparting the beam of radiation with a desired pattern in its cross-section based on a patterning device;

positioning said substrate on an object carrier, said object carrier being moveable by a first and a second linear actuator in a first direction and by a third and a fourth linear actuator in a second direction, said first and second linear actuators being adapted to support said object carrier by having a coil structure and a magnetic structure that are separated by an air bearing attached to the coil structure or the magnetic structure and configured to support said object carrier during motion at a first position along said first direction, the first position being on one end of whichever of the magnetic structure or coil structure is connected to the object carrier, and at a second position displaced from the first position along said first direction, the second position being on the opposite end of whichever of the magnetic structure or coil structure is connected to the object carrier, wherein the first and second positions and whichever of the magnetic structure or coil structure is connected to the object carrier are substantially in a same plane, and wherein both the coil structure and the magnetic structure of the first and second linear actuators are moveable with respect to each other or both a coil structure and a magnetic structure of the third and fourth linear actuators are moveable with respect to each other, the coil structure or the magnetic structure of the respective pair of coil structure and magnetic structure of the respective linear actuator configured as a balance mass to receive reaction forces arising from the movement of the other of the coil structure or the magnetic structure;

controlling said first and second linear actuators to move said object carrier in said first direction; and

projecting the patterned beam of radiation onto a target portion of the substrate.

26. (**Previously Presented**) The method of Claim 19, wherein said third and fourth linear actuators support said first and second linear actuators.

27. (**Previously Presented**) The method of Claim 26, wherein said third and fourth linear actuators each comprise an air bearing supporting said first and second linear actuators.

28. (**Previously Presented**) The method of Claim 26, wherein said first and second linear actuators are positioned relative to said third and fourth linear actuators such that a common center of gravity of said first and second linear actuators is positioned between said third and fourth linear actuators.

29. (**Previously Presented**) The method of Claim 19, wherein said magnetic structure includes a row of alternating magnetic poles on an outer surface thereof, said row being orientated in said first direction; and

said coil structure includes an iron core with a number of teeth in a row orientated in said first direction and having a number of coils wound around a respective number of said teeth;

wherein the relative positioning of the coil structure and the magnetic structure is configured so that the row of magnetic poles is positioned opposing the row of teeth, around which coils are wound.

30. (**Previously Presented**) The method of Claim 19, wherein said object carrier is positioned relative to said first and second linear actuators such that a vertical line through a center of gravity of said object carrier is located between said first and second linear actuators.